REVISIONS			
LTR	DESCRIPTION	DATE (YR-MO-DA)	APPROVED

REV																									
SHEET																									
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REV STATUS OF SHEETS	REV																								
	SHEET	1	2	3	4	5	6	7	8	9	10	11	12	13											

PMIC N/A

STANDARDIZED MILITARY DRAWING

THIS DRAWING IS AVAILABLE FOR USE BY ALL DEPARTMENTS AND AGENCIES OF THE DEPARTMENT OF DEFENSE

AMSC N/A

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DRAWING APPROVAL DATE: 28 FEBRUARY 1990

REVISION LEVEL:

DEFENSE ELECTRONICS SUPPLY CENTER
DAYTON, OHIO 45444

MICROCIRCUIT, LINEAR, 12-BIT D/A CONVERTER, HYBRID

SIZE	CAGE CODE	
A	67268	5962-89528

SHEET 1

DESC FORM 193
SEP 87

5962-E1190

DISTRIBUTION STATEMENT A. Approved for public release; distribution is unlimited.

1. SCOPE

1.1 Scope. This drawing describes device requirements for class B hybrid microcircuits to be processed in full accordance with MIL-H-38534.

1.2 Part number. The complete part number shall be as shown in the following example:

5962-89528	01	X	X
Drawing number	Device type (1.2.1)	Case outline (1.2.2)	Lead finish per MIL-M-38510

1.2.1 Device types. The device types shall identify the circuit function as follows:

Device type	Generic number	Circuit function
01	DAC-HKB	D/A converter, 12-bit binary input code
02	DAC-HKB-2	D/A converter, 12-bit two's complement

1.2.2 Case outlines. The case outlines shall be as designated in appendix C of MIL-M-38510, and as follows:

Outline letter	Case outline
X	See figure 1 (24-lead, 1.33" x .800" x .266") dual-in-line package

1.3 Absolute maximum ratings.

Positive supply voltage (V_{CC})	-0.3 V to +18 V dc
Negative supply voltage (V_{EE})	+0.3 V to -18 V dc
Logic supply voltage (V_{DD})	-0.3 V to +7 V dc
Analog output voltage	$\pm V_S$
Output current	±20 mA
Digital inputs	+5.5 V dc
Junction temperature (T_J)	+175°C
Storage temperature	-65°C to +125°C
Lead temperature (soldering, 10 seconds)	+300°C
Power dissipation (P_D)	1.35 W
Thermal resistance:	
Junction-to-case (θ_{JC})	12°C/W
Junction-to-ambient (θ_{JA})	49°C/W

1.4 Recommended operating conditions.

Positive supply voltage range (V_{CC})	+14.5 V dc to +15.5 V dc
Negative supply voltage range (V_{EE})	-14.5 V dc to -15.5 V dc
Logic supply voltage range (V_{DD})	+4.5 V dc to +5.5V dc
Ambient operating temperature range (T_A)	-55°C to +125°C
Write pulse width	50 ns minimum
Data setup time	50 ns minimum
Data hold time	20 ns minimum

2. APPLICABLE DOCUMENTS

2.1 Government specifications, standards, and bulletin. Unless otherwise specified, the following specifications, standards, and bulletin of the issue listed in that issue of the Department of Defense Index of Specifications and Standards specified in the solicitation, form a part of this drawing to the extent specified herein.

SPECIFICATIONS

MILITARY

MIL-M-38510	-	Microcircuits, General Specification for.
MIL-H-38534	-	Hybrid Microcircuits, General Specification for.

STANDARDS

MILITARY

MIL-STD-883	-	Test Methods and Procedures for Microelectronics.
MIL-STD-1772	-	Certification Requirements For Hybrid Microcircuits Facilities and Lines.

BULLETIN

MILITARY

MIL-BUL-103	-	List of Standardized Military Drawings (SMD's).

(Copies of the specifications, standards, and bulletin required by manufacturers in connection with specific acquisition functions should be obtained from the contracting activity or as directed by the contracting activity.)

2.2 Order of precedence. In the event of a conflict between the text of this drawing and the references cited herein, the text of this drawing shall take precedence.

3. REQUIREMENTS

3.1 Item requirements. The individual item requirements shall be in accordance with MIL-H-38534 and as specified herein.

3.2 Design, construction, and physical dimensions. The design, construction, and physical dimensions shall be as specified in MIL-H-38534 and herein.

3.2.1 Terminal connections. The terminal connections shall be as specified on figure 2.

3.2.3 Functional diagram. The functional diagram shall be as specified on figure 3.

3.2.4 Truth tables. The truth tables shall be as specified on figure 4.

3.2.5 Case outline. The case outline shall be in accordance with 1.2.2 herein.

3.3 Electrical performance characteristics. Unless otherwise specified herein, the electrical performance characteristics are as specified in table I and shall apply over the full ambient operating temperature range.

3.4 Electrical test requirements. The electrical test requirements shall be the subgroups specified in table II. The electrical tests for each subgroup are described in table I.

3.5 Marking. Marking shall be in accordance with MIL-H-38534. The part shall be marked with the part number listed in 1.2 herein. In addition, the manufacturer's part number may also be marked as listed in MIL-BUL-103 (see 6.6 herein).

TABLE I. Electrical performance characteristics.

Test	Symbol	Conditions $-55°C < T_A < +125°C$ unless otherwise specified 1/	Device type	Group A subgroups	Limits Min	Limits Max	Unit
Resolution	RES	Binary input code Two's compliment input code	01 02	1, 2, 3 1, 2, 3	12 12		BITS
Linearity error	LE	Major sums, carries	All	1		0.5	LSB
				2, 3		0.75	
Differential linearity error	DLE	Monotonic over temperature	All	1		0.75	LSB
				2, 3		1.0	
Gain error	GE	V_O = +FS, +10 & ±10 V FSR	All	4		0.1	%FSR
				5, 6		0.2	
Unipolar offset error	UOE	V_O = 0 V, ±10 V range	All	1		0.05	%FSR
				2, 3		0.1	
Bipolar offset error	BOE	V_O = -10 V, ±10 V range	All	1		0.1	%FSR
				2, 3		0.2	
Reference error	V_{ERR}	V_{REF} = -6.300 V	All	1	6.23	6.37	V
				2, 3	6.218	6.382	
Reference current	I_{REF}	For external use 2/	All	1	2		mA
Slew rate	SL	10 V step	All	4	10		V/µs
Settling time	t_S	20 V step to 0.01% FSR 10 V step to 0.01% FSR 5 V step to 0.01% FSR 1 LSB step to 0.01% FSR	All	9		4 3 3 800	µs
DC feedthrough error	FTE	Latch at +FS change	All	1, 2, 3		1	mV
Functional test		See 4.3	All	7			

See footnotes at end of table.

TABLE I. Electrical performance characteristics - Continued.

Test	Symbol	Conditions $-55°C \le T_A \le +125°C$ unless otherwise specified 1/	Group A subgroups	Limits		Unit
				Min	Max	
Output current	I_{OUT}	±10 V FSR, R_L = 1.9 kΩ	1, 2, 3	±5		mA
Power supply rejection ratio	PSSR	Worst case V_S = ±5 V	1, 2, 3		0.004	%FS/%V_S
Power supply current	I_{CC} I_{EE} I_{DD}	V_{CC} = +15.5 V V_{EE} = -15.5 V V_{DD} = +5.5 V	1, 2, 3		+17 -25 +50	mA
Power dissipation	P_D	V_S = ±15.5 V, +5.5 V	1, 2, 3		926	mW
Digital input voltage (high) (low)	V_{IH} V_{IL}	I_{IH} = -40 µA I_{IL} = +2.4 mA	1, 2, 3	2.0	 0.8	V
Digital input current (high) (low)	I_{IH} I_{IL}	V_{IH} = +2.0 V V_{IL} = +0.8 V	1, 2, 3		-40 2.4	µA mA
Strobe input current (high) (low)	I_{SIH} I_{SIL}	V_{SIH} = 2.0 V V_{SIL} = 0.8 V	1, 2, 3		-120 4.8	µA mA

1/ Unless otherwise specified, the following conditions apply:
V_{CC} = +15 V dc, V_{EE} = -15 V dc, V_{DD} = +5 V dc.
Logic "0" = +0.8 V dc, Logic "1" = +2.0 V dc
VFSR = 20 V dc
Bipolar operation, no load applied, using internal reference.

2/ If more than 10 µA is drawn externally, the reference temperature cofficient will increase resulting in a proportional change in the gain and bipolar offset performance.

Case X

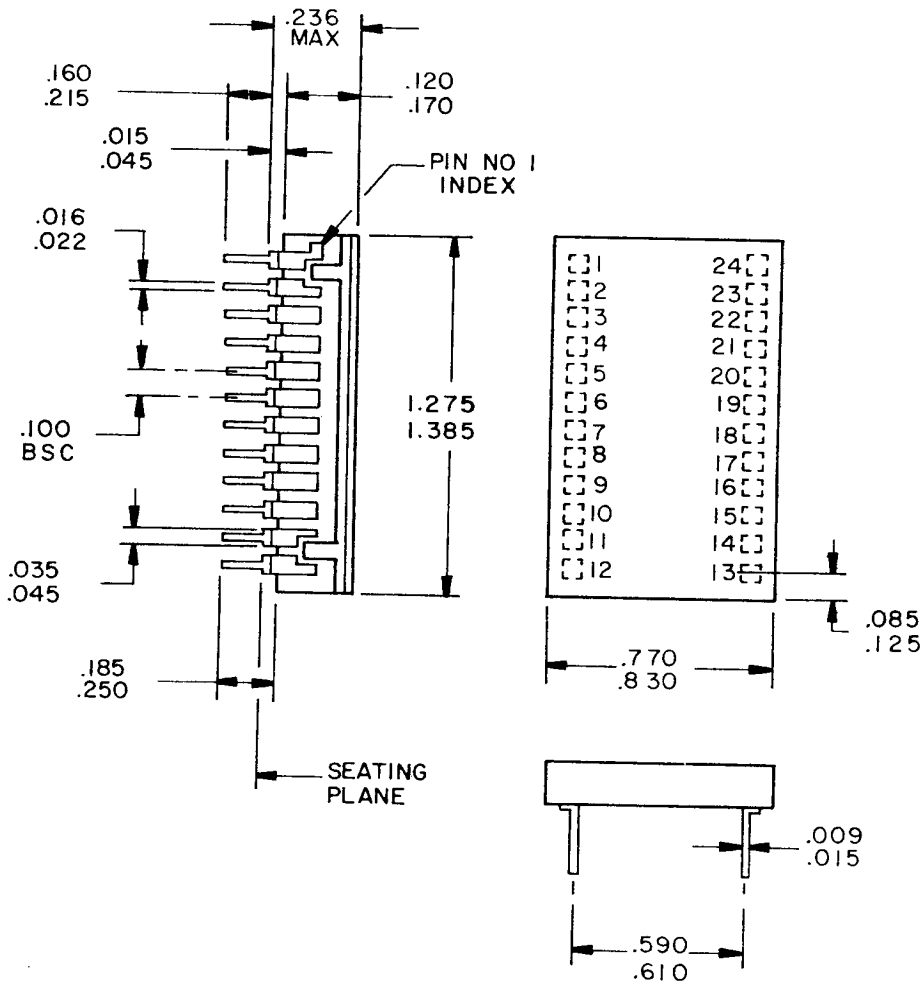

FIGURE 1. Case outline.

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Inches	mm	Inches	mm
.009	0.23	.170	4.32
.015	0.38	.185	4.70
.016	0.41	.215	5.46
.022	0.56	.236	5.99
.035	0.89	.250	6.15
.045	1.14	.590	14.99
.085	2.16	.610	15.49
.100	2.54	.770	19.56
.120	3.05	.830	21.08
.125	3.18	1.275	32.39
.160	4.06	1.385	35.18

NOTES:
1. Dimensions are in inches.
2. Metric equivalents are given for general information only.

FIGURE 1. Case outline - Continued.

All devices

Case outline X

Pin	Function	Pin	Function
1	Bit 1 (MSB)	13	V_{DD}
2	BIT 2	14	V_{EE}
3	BIT 3	15	OUTPUT
4	BIT 4	16	LOAD
5	BIT 5	17	BIPOLAR OFFSET
6	BIT 6	18	10 V RANGE
7	BIT 7	19	20 V RANGE
8	BIT 8	20	SUM JUNCTION
9	BIT 9	21	GROUND
10	BIT 10	22	V_{CC}
11	BIT 11	23	GAIN ADJ
12	BIT 12 (LSB)	24	REF OUT

FIGURE 2. Terminal connections.

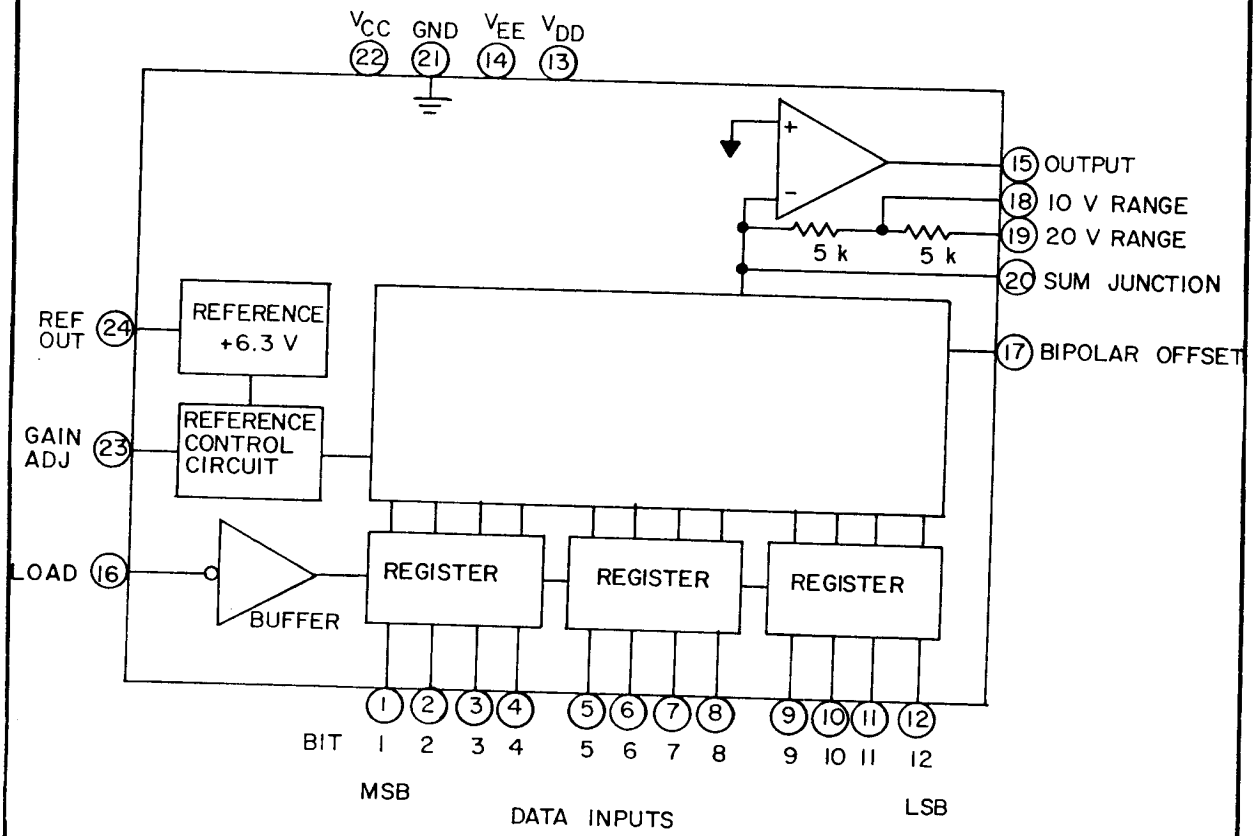

FIGURE 3. Functional diagram.

Bipolar operation

Device type 01	Device type 02	Output ranges		
MSB LSB	MSB LSB	±10 V	±5 V	±2.5 V
1111 1111 1111	0111 1111 1111	+9.9951	+4.9976	+2.4988
1100 0000 0000	0100 0000 0000	+5.0000	+2.5000	+1.2500
1000 0000 0000	0000 0000 0000	0.0000	0.0000	0.0000
0100 0000 0000	1100 0000 0000	-5.0000	-2.5000	-1.2500
0000 0000 0001	1000 0000 0001	-9.9951	-4.9976	-2.4988
0000 0000 0000	1000 0000 0000	-10.0000	-5.0000	-2.5000

Unipolar operation

All device types	Output ranges	
MSB LSB	0 V to +10 V	0 V to +5 V
1111 1111 1111	+9.9976	+4.9988
1100 0000 0000	+7.5000	+3.7500
1000 0000 0000	+5.0000	+2.5000
0100 0000 0000	+2.5000	+1.2500
0000 0000 0001	+0.0024	+0.0012
0000 0000 0000	0.0000	0.0000

FIGURE 4. Truth tables.

3.6 Manufacturer eligibility. As a minimum, the manufacturer listed herein shall be certified to section A of MIL-STD-1772. In addition to the general requirements of MIL-H-38534, the manufacturer of the part described herein shall submit for DESC-ECC review and approval electrical test data (variables format) on 22 devices from the initial QCI group A lot sample, produced on the certified line, for each device type listed herein. The data should also include a summary of all parameters manually tested, and for those which, if any, are guaranteed.

3.7 Certificate of compliance. A certificate of compliance shall be required from a manufacturer in order to be listed as an approved source of supply in MIL-BUL-103 (see 6.6 herein). The certificate of compliance submitted to DESC-ECC prior to listing as an approved source of supply shall affirm that the manufacturer's product meets the requirements of MIL-H-38534 and the requirements herein.

3.8 Certificate of conformance. A certificate of conformance as required in MIL-H-38534 shall be provided with each lot of microcircuits delivered to this drawing.

3.9 Notification of change. Notification of change to DESC-ECC shall be required in accordance with MIL-H-38534.

4. QUALITY ASSURANCE PROVISIONS

4.1 Sampling and inspection. Sampling and inspection procedures shall be in accordance with MIL-H-38534 and method 5008 of MIL-STD-883.

4.2 Screening. Screening shall be in accordance with method 5008 of MIL-STD-883, and shall be conducted on all devices prior to quality conformance inspection. The following additional criteria shall apply:

a. Burn-in test, method 1015 of MIL-STD-883.

(1) Test condition A, B, C, or D using the circuit submitted with the certificate of compliance (see 3.7 herein).

(2) T_A as specified in accordance with table I of method 1015 of MIL-STD-883.

b. Interim and final electrical test parameters shall be as specified in table II herein, except interim electrical parameter tests prior to burn-in are optional at the discretion of the manufacturer.

4.3 Quality conformance inspection. Quality conformance inspection shall be in accordance with MIL-H-38534 and as specified herein. Inspections to be performed shall be those specified in method 5008 and herein for groups A, B, C, and D inspections (see 4.3.1 through 4.3.4).

4.3.1 Group A inspection. Group A inspection shall be in accordance with table X of method 5008 of MIL-STD-883 and as follows:

a. Tests shall be as specified in table II herein.

b. Subgroups 8, 10, and 11 in table X, method 5008 of MIL-STD-883 shall be omitted.

c. Subgroup 7 shall include verification of the truth table.

4.3.2 Group B inspection. Group B inspection shall be in accordance with table XI of method 5008 of MIL-STD-883.

TABLE II. Electrical test requirements.

MIL-STD-883 test requirements	Subgroups (per method 5008, group A test table)
Interim electrical parameters	1
Final electrical test parameters	1*,2,3,4,5,6,7,9
Group A test requirements	1,2,3,4,5,6,7,9
Group C end-point electrical parameters	1

*PDA applies to subgroup 1.

4.3.3 Group C inspection. Group C inspection shall be in accordance with table XII of method 5008 of MIL-STD-883 and as follows:

a. End-point electrical parameters shall be as specified in table II herein.

b. Steady-state life test conditions, method 1005 of MIL-STD-883.

(1) Test condition A, B, C, or D using the circuit submitted with the certificate of compliance (see 3.7 herein).

(2) T_A as specified in accordance with table I of method 1005 of MIL-STD-883.

(3) Test duration: 1,000 hours, except as permitted by method 1005 of MIL-STD-883.

4.3.4 Group D inspection. Group D inspection shall be in accordance with table XIII of method 5008 of MIL-STD-883.

5. PACKAGING

5.1 Packaging requirements. The requirements for packaging shall be in accordance with MIL-M-55565.

6. NOTES

6.1 Intended use. Microcircuits conforming to this drawing are intended for original equipment design applications and logistic support of existing equipment.

6.2 Replaceability. Microcircuits covered by this drawing will replace the same generic device covered by a contractor-prepared specification or drawing.

6.3 Configuration control of SMD's. All proposed changes to existing SMD's will be coordinated with the users of record for the individual documents. This coordination will be accomplished in accordance with MIL-STD-481 using DD Form 1693, Engineering Change Proposal (Short Form).

6.4 Record of users. Military and industrial users shall inform Defense Electronics Supply Center when a system application requires configuration control and the applicable SMD. DESC will maintain a record of users and this list will be used for coordination and distribution of changes to the drawings. Users of drawings covering microelectronics devices (FSC 5962) should contact DESC-ECC, telephone (513) 296-8527.

6.5 Comments. Comments on this drawing should be directed to DESC-ECC, Dayton, Ohio 45444, or telephone (513) 296-8525.

6.6 Approved source of supply. An approved source of supply is listed in MIL-BUL-103. Additional sources will be added to MIL-BUL-103 as they become available. The vendors listed in MIL-BUL-103 have agreed to this drawing and a certificate of compliance (see 3.7 herein) has been submitted to and accepted by DESC-ECC. The approved source of supply listed below is for information purposes only and is current only to the date of the last action of this document.

Military drawing part number	Vendor CAGE number	Vendor similar part number 1/
5962-8952801XX	50721	DAC-HBK/883B
5962-8952802XX	50721	DAC-HBK-2/883B

1/ Caution. Do not use this number for item acquisition. Items acquired to this number may not satisfy the performance requirements of this drawing.

Vendor CAGE number	Vendor name and address
50721	Datel, Incorporated 11 Cabot Boulevard Mansfield, MA 02048

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